



Towards an Integrated Water Quality Toolbox

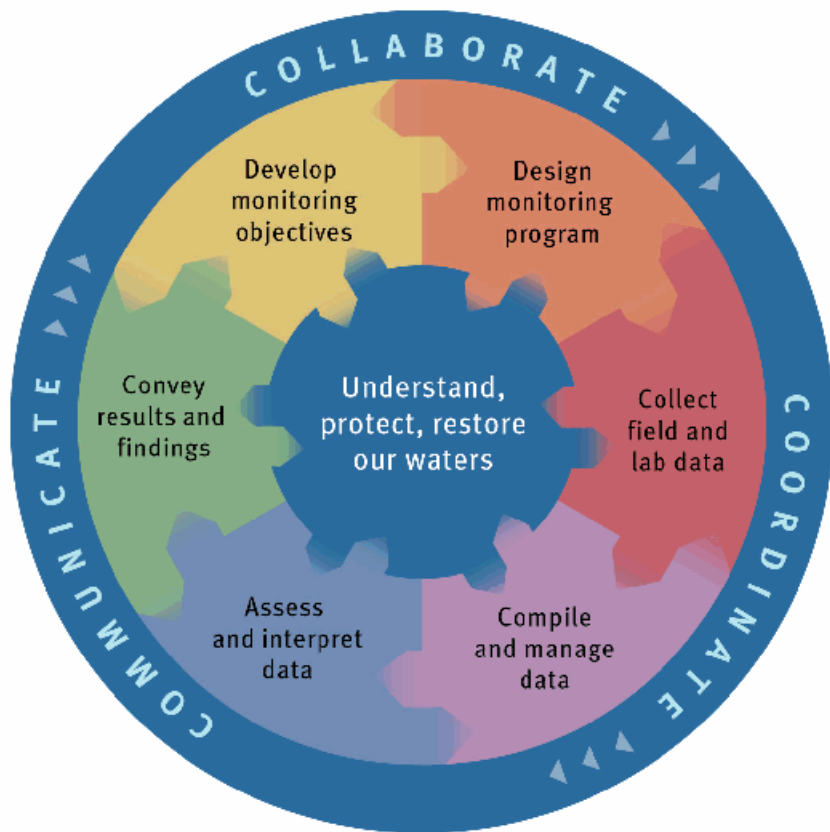
Henry B. Manguerra, John Zastrow, Gustavo Lopez, Haihong Yang, and Vaishal Sheth

Tetra Tech, Inc.
Fairfax, VA



TETRA TECH, INC.

Framework for Monitoring and Assessment



Framework for Monitoring

Why a Framework??

- Multiple Agencies
- Various Practices
- Various Database Technologies
- Various Analytical and Presentation Techniques

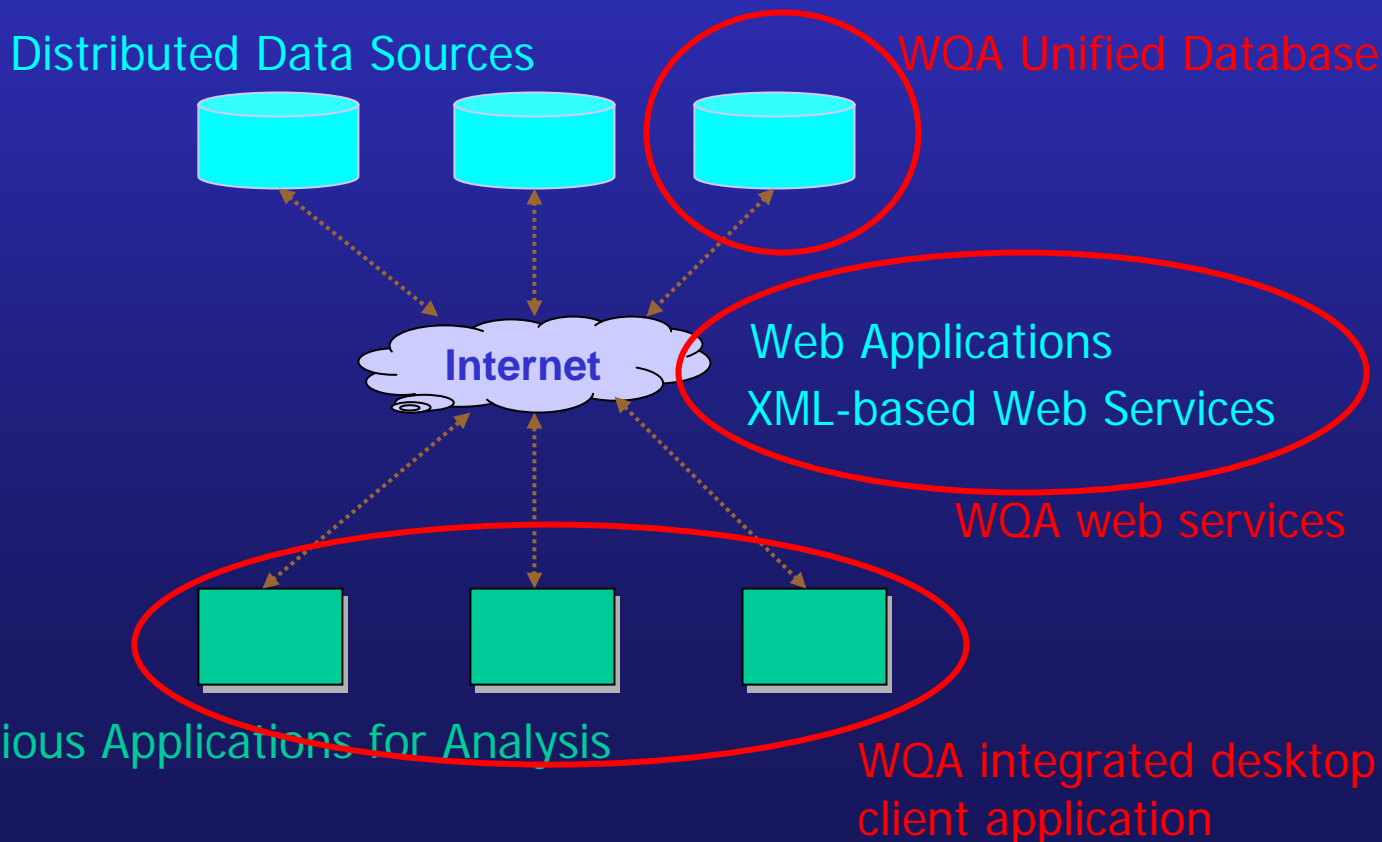
Framework for:

- Collecting and Storing Data
- Using Data



Framework for Access and Analysis

Framework = Medium + Suite of Tools = WQA



WQA Background

- Some of the projects that led to the conceptualization of WQA
 - Utah Data Assessment and Integration Tools to Support TMDL Development
 - Impairment Analysis for Southwest Florida Watersheds
 - Water Quality Exceedance Analysis for El Paso, Colorado




Project: Utah Data Assessment and Integration Tools

- Objective
 - Provide Utah DWQ staff easy access to water quality data to support TMDL development
- Background
 - Utah Modern STORET database
 - EPA BASINS and spreadsheet-based tools for TMDL development
- Key Development Milestone
 - UDAIT Web Application



Project: Utah Data Assessment and Integration Tools

Department of Environmental Quality



Division of Water Quality

Select Area > Review Selection

Logout

Themes Legend

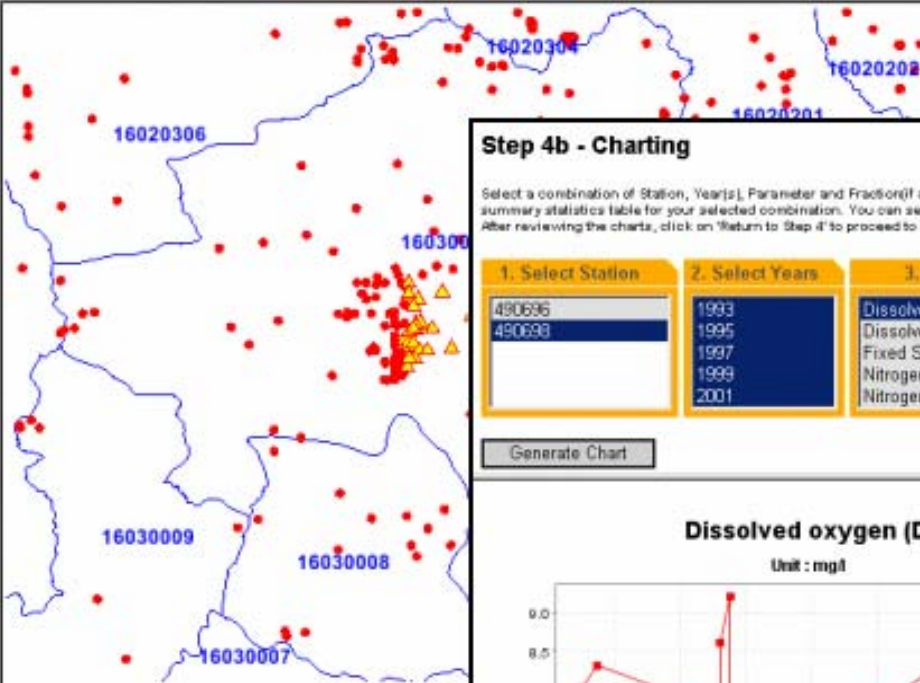
Step 3 Review Selection

☒ Stations
☒ NHD - Reaches
☒ NHD - Waterbodies
☐ HUC Boundaries (12 Digit)
☒ HUC Boundaries (8 Digit)
☐ County Boundaries
☐ State Boundary

Refresh

Next Step >>

Select multiple features by pressing the [Shift] key and clicking on the map.



Step 4b - Charting

Select a combination of Station, Year[s], Parameter and Fraction(if available) and click the 'Generate Chart' button to generate a time-series chart and a summary statistics table for your selected combination. You can select only one station, parameter and fraction at a time but you can select multiple years. After reviewing the charts, click on 'Return to Step 4' to proceed to download data.

1. Select Station

2. Select Years

3. Select Parameter

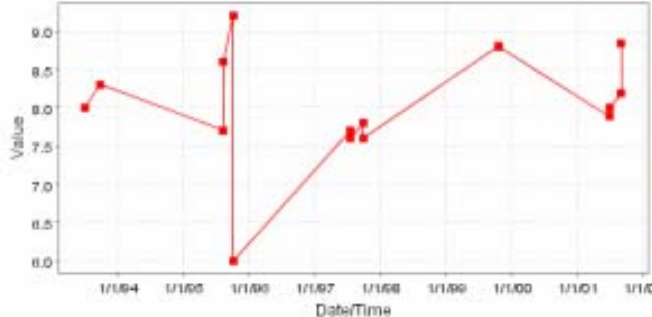
3. Select Fraction

Generate Chart

Return to Step 4

Dissolved oxygen (DO)

Unit : mg/l



Year	Detection Condition	Obs	Min	Max	Avg
1993	Detected and Quantified	2	8	8.3	8.15
1995	Detected and Quantified	4	6	9.2	7.88
1997	Detected and Quantified	4	7.6	7.6	7.68
1999	Detected and Quantified	2	8.8	8.8	8.8
2001	Detected and Quantified	4	7.89	8.84	8.23

Project: Impairment Analysis for Southwest Florida Watersheds

- Project Objective
 - Determine waters of concern within the South Florida watersheds.
- Background
 - Multiple data sources
 - Complex Florida Impaired Waters Rule
- Key Development Milestone
 - Automating impairment analysis



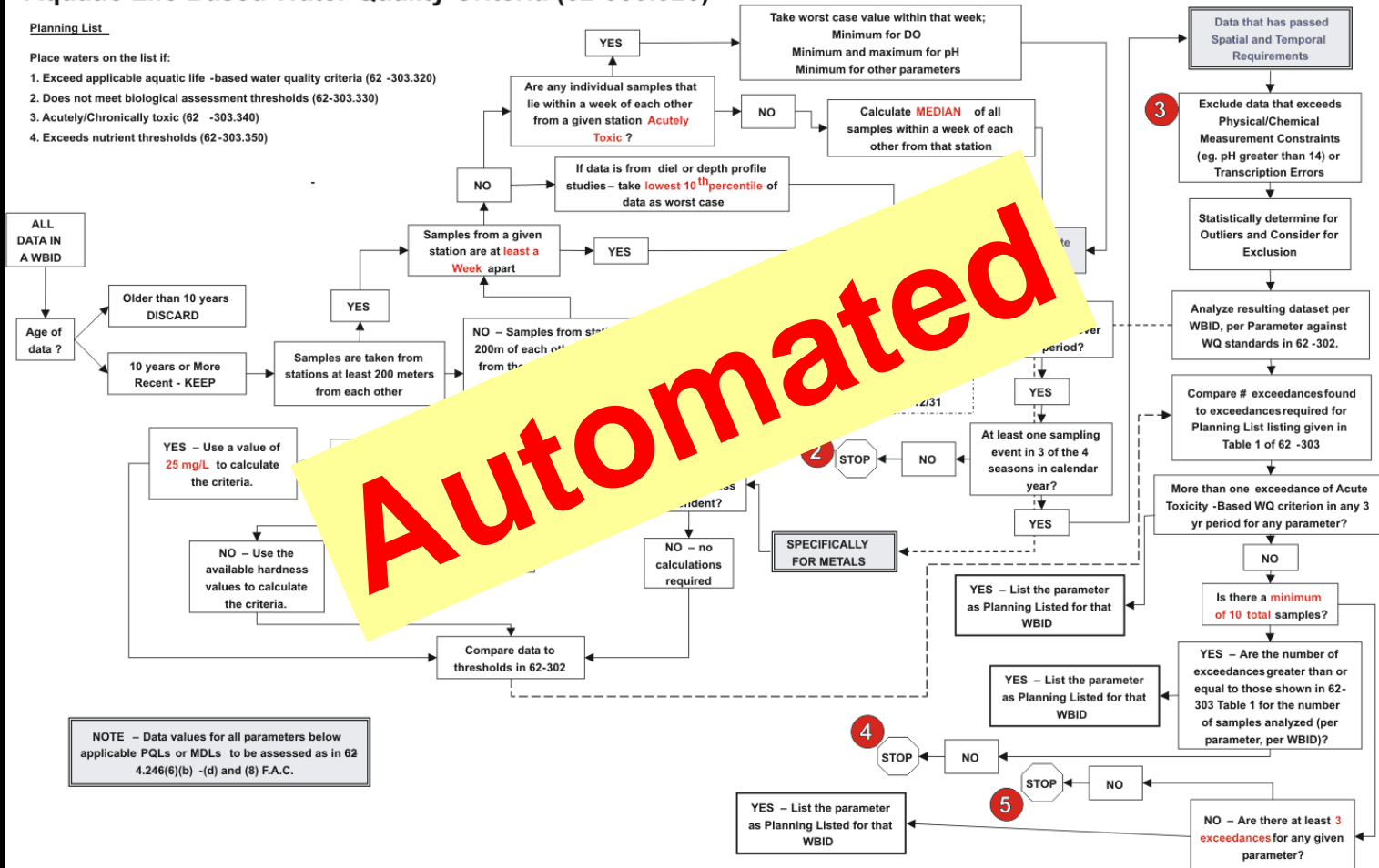
Florida IWRule for Aquatic Life Based Criteria

Aquatic Life Based Water Quality Criteria (62-303.320)

Planning List

Place waters on the list if:

1. Exceed applicable aquatic life -based water quality criteria (62 -303.320)
2. Does not meet biological assessment thresholds (62-303.330)
3. Acutely/Chronically toxic (62 -303.340)
4. Exceeds nutrient thresholds (62-303.350)

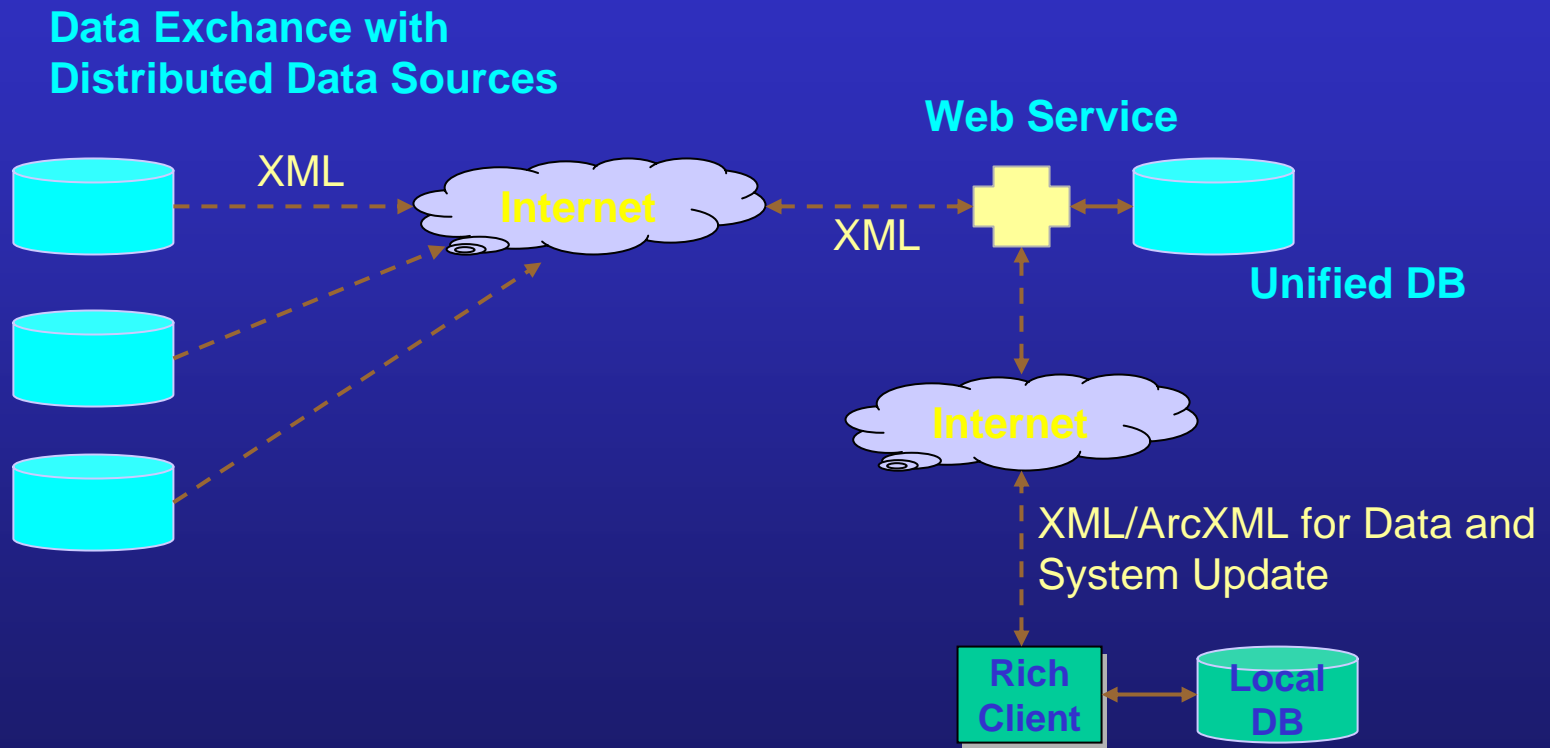


Project: Water Quality Exceedance Analysis, El Paso, Colorado

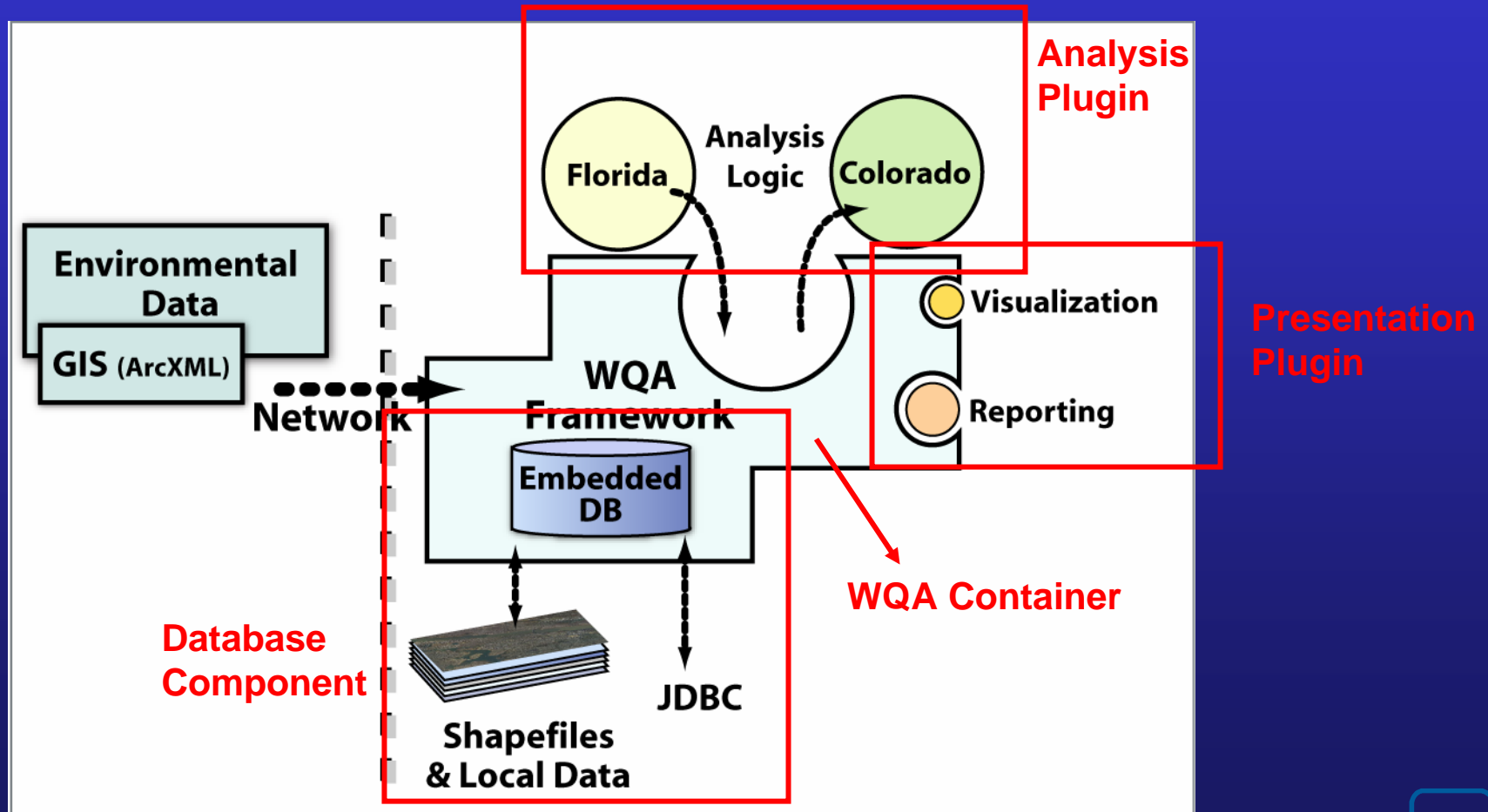
- Objective
 - Determine water quality exceedances at monitoring stations within El Paso county using State of Colorado Water Quality Criteria.
- Background
 - EPA HQ modern STORET database
 - Yet another set of standards and rules for analysis (compared to Florida)
- Key Development Milestone
 - Desktop application to provide local copy of data for a particular project (GIS, standards, water quality data)



WQA Conceptually

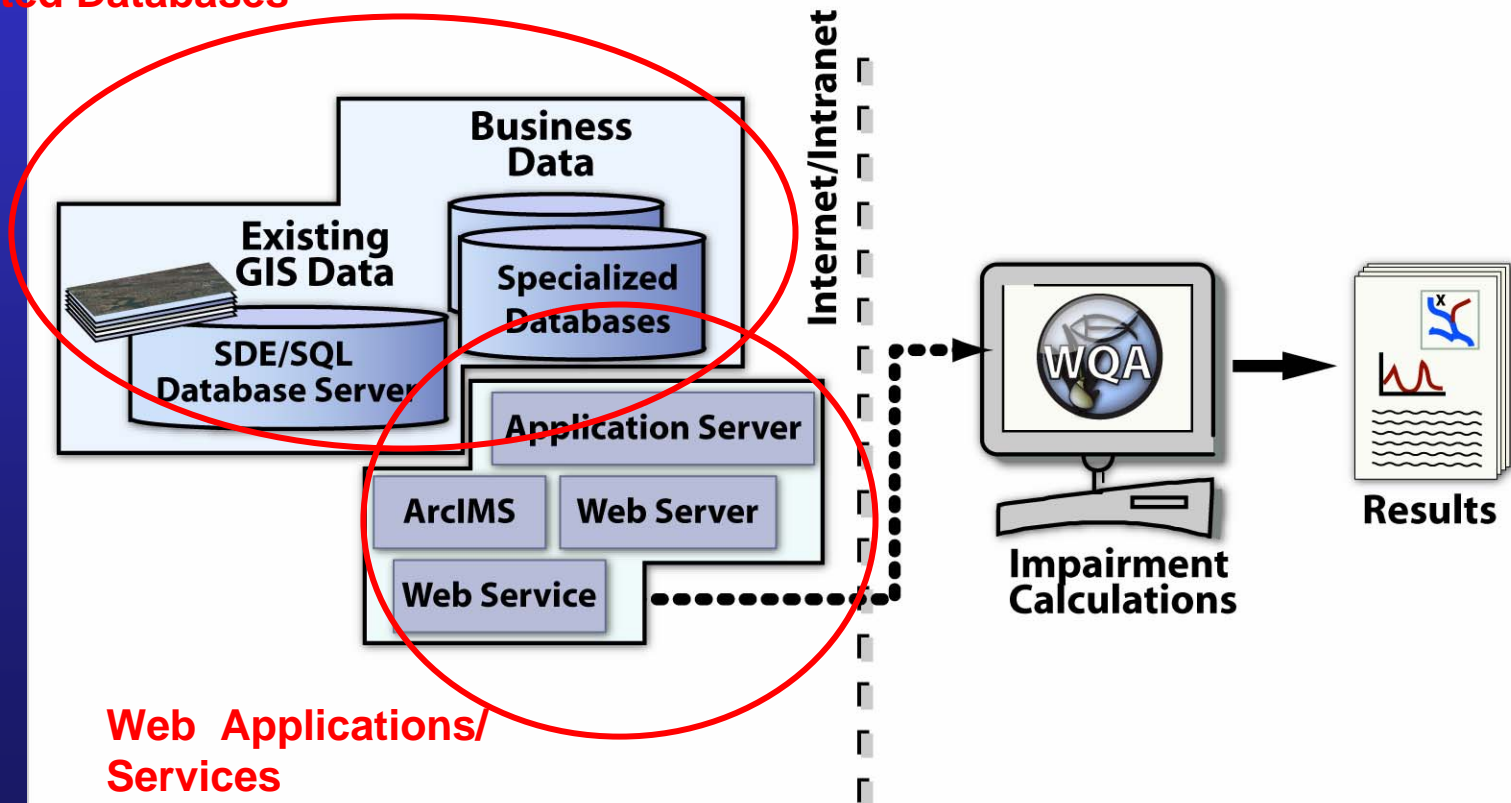


WQA Client Application - Components



WQA Server Side Components

**WQA Unified DB and
Distributed Databases**

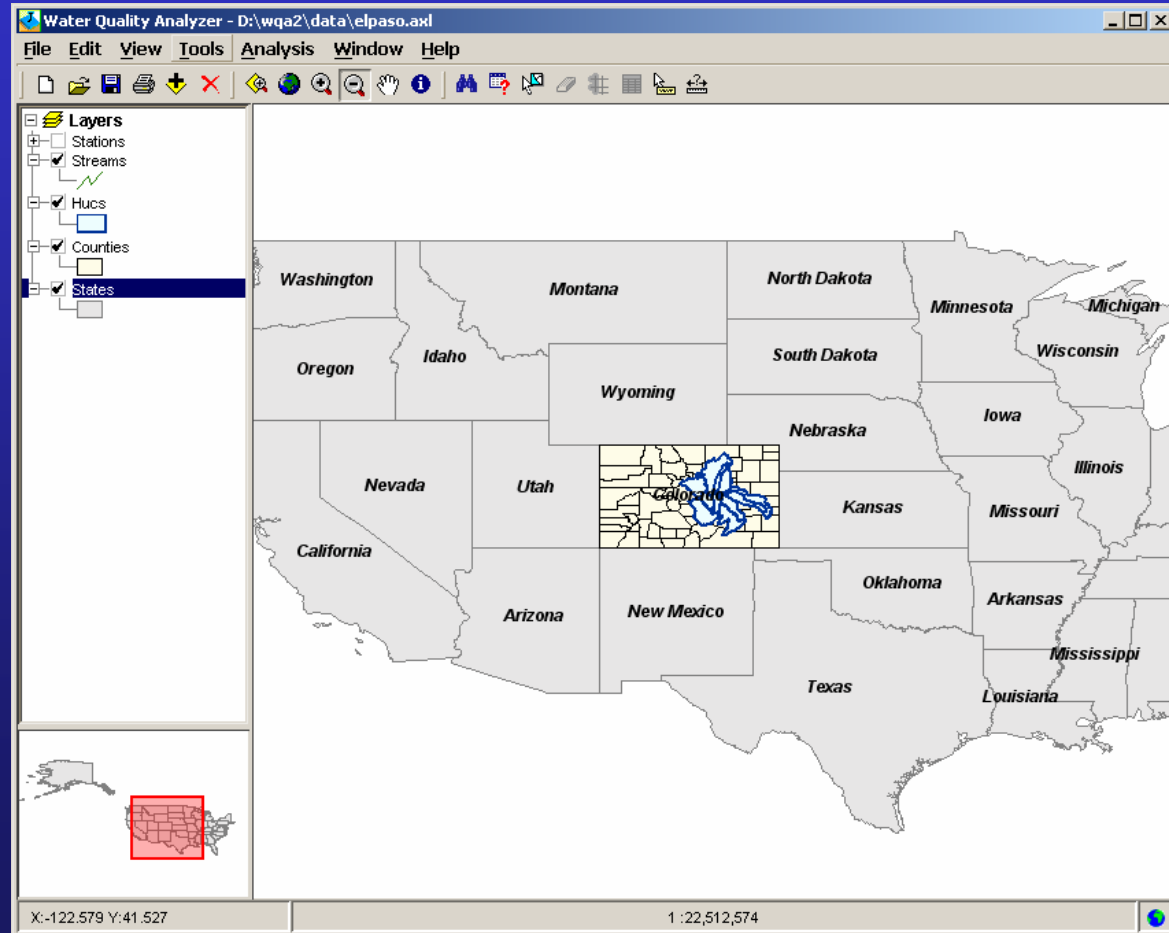
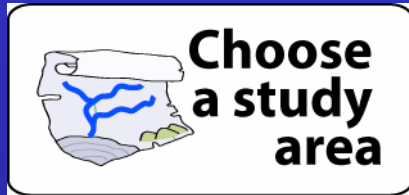


WQA Technologies

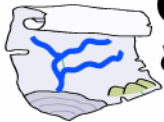
- WQA Unified Database
 - Oracle 9i
- Web Services
 - Microsoft .Net
 - ArcIMS 4.1 ArcXML Web Services
- Rich Client
 - Map Objects Java Edition 2.0



WQA Step 1 – Choose a Study Area



WQA Step 2 – Build a Project



**Choose
a study
area**



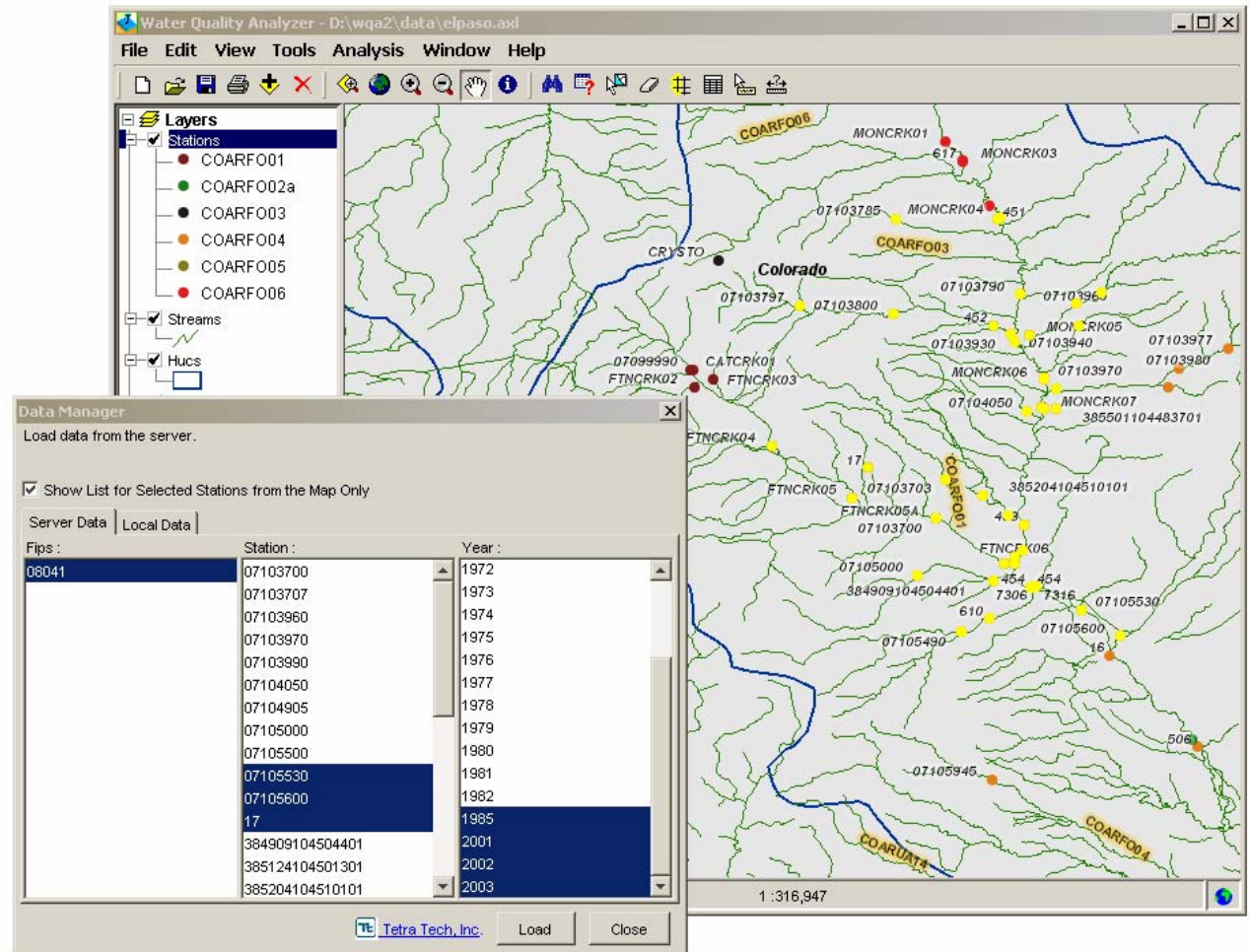
**Build a
project**



**Extract
geospatial
data**

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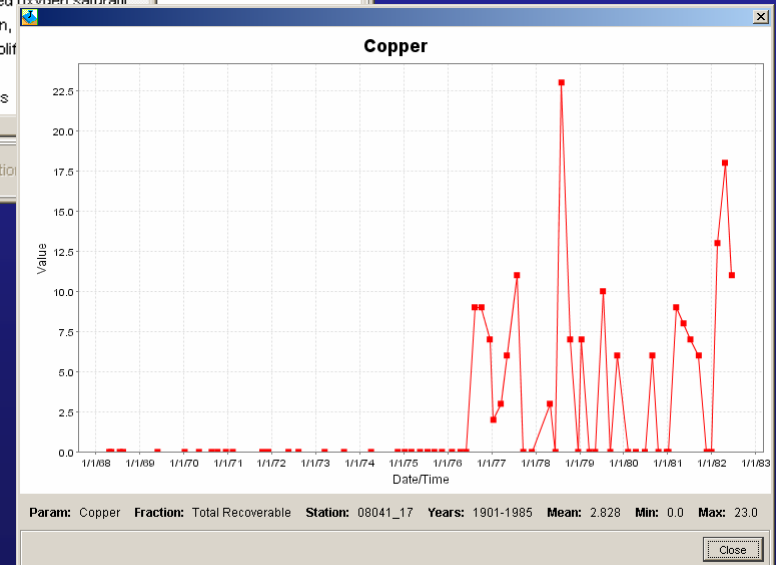
**Retrieve
tabular data**




WQA Step 3 – Review Data



StationIDs	Years	Parameters	Fractions
08041_FTNCRK04	1901	Alkalinity, Total - carbonate	Total Recoverable
08041_17	1968	Aluminum	
08041_FTNCRK05	1969	Ammonia, unionized	
08041_FTNCRK06	1970	Arsenic	
08041_FTNCRK05A	1971	BOD, Biochemical oxygen	
08041_454	1972	Beryllium	
08041_454	1973	Boron	
08041_7306	1974	Cadmium	
08041_7316	1975	Calcium as CaCO3	
08041_452	1976	Chloride	
08041_610	1977	Chromium	
08041_MONCRK04	1978	Chromium, hexavalent	
08041_MONCRK05	1979	Copper	
08041_MONCRK06	1980	Cyanide	
08041_MONCRK07	1981	Dissolved Solids	
08041_MONCRK08	1982	Dissolved oxygen (DO)	
08041_451	1985	Dissolved oxygen saturati	
08041_453		Elevation,	
08041_07103700		Fecal Colif	
08041_07103703		Flow	
08041_07103707		Fluorides	




WQA Step 4 – Calculate Impairments



**Choose
a study
area**



**Build a
project**



**Extract
geospatial
data**



**Retrieve
tabular data**

**Review
Data**



**Calculate
Impairments**



Entity Details

Entity ID: COARF001

Param: Ammonia, unionized

Fraction:

Units: mg/l

Standard: value may not be > 0.02

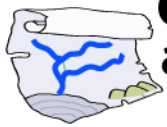
Station ID	Date	Value
08041_17	1969-09-04	0.0405
08041_17	1975-07-17	0.0875
08041_17	1980-06-24	0.0222
08041_FTNCRK05	1985-08-08	0.0607
08041_17	1968-09-19	0.0033
08041_17	1968-10-03	0.0060
08041_17	1968-11-14	0.0
08041_17	1968-12-05	0.0027
08041_17	1969-01-30	0.0
08041_17	1969-04-23	0.0
08041_17	1969-05-28	0.0099

Results

Entity ID	Param	Fraction	Unit	Exceedan...	Samples	% Failed	Standard	Mean	Minimum	Maximum
COARF001	Ammonia, unionized		mg/l	4	82	4.9%	>0.02	0.004	0.0	0.0875
COARF001	Arsenic	Total	ug/l	0	56	0%	>50	1.196	0.0	34.0
COARF001	Boron	Total	ug/l	0	56	0%	>750	29.214	0.0	130.0
COARF001	Cyanide	Total	ug/l	4	6	66.7%	>0.005	0.035	0.0	0.18
COARF001	Dissolved oxygen (DO)		mg/l	1	89	1.1%	<=6	9.927	5.7	13.0
COARF001	Fecal Coliform		#/100ml	72	146	49.3%	>229	1,189.877	0.0	54000.0
COARF001	Mercury	Total	ug/l	1	1	100%	>0.01	0.5	0.5	0.5
COARF001	Nitrogen, Nitrate (NO3) as NO3	Total	mg/l	0	78	0%	>10	0.949	0.0	8.8
COARF001	Nitrogen, Nitrite (NO2) as NO2	Total	mg/l	0	61	0%	>0.05	0.006	0.0	0.047
COARF001	Selenium	Dissolved	ug/l	13	34	38.2%	>4.6	3.997	0.0	14.0
COARF001	pH		ug/l	2	198	1%	>9	8.754	6.9	79.0
COARF002a	Arsenic	Total Reco...	ug/l	0	15	0%	>50	3.4	1.0	10.0
COARF002a	Arsenic	Total	ug/l	0	25	0%	>50	4	1.0	18.0
COARF002a	Cyanide	Total	ug/l	3	6	50%	>0.005	0.005	0.0	0.04

Tetra Tech, Inc. Export Summary Close

WQA Step 5 – Inspect Output



**Choose
a study
area**



**Build a
project**

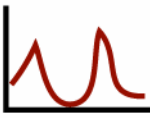


**Extract
geospatial
data**

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**Retrieve
tabular data**

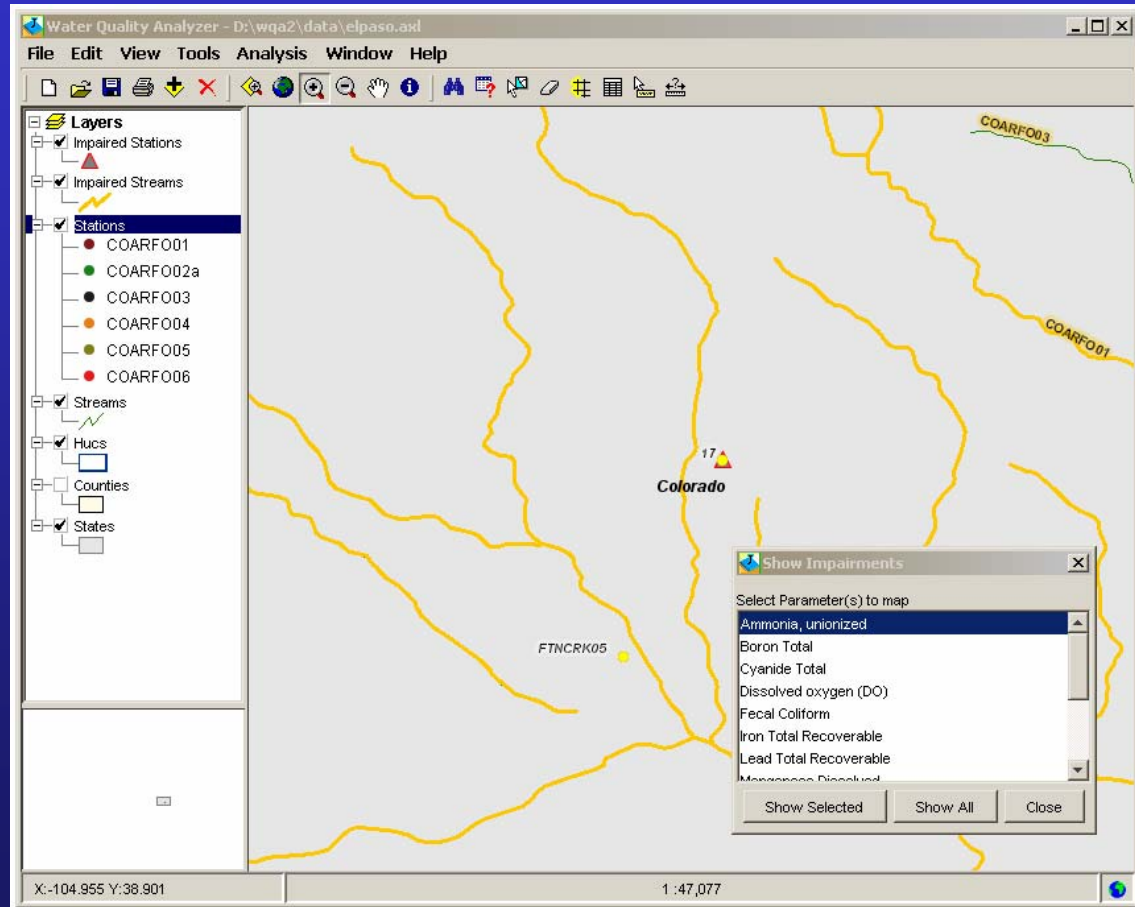
**Review
Data**

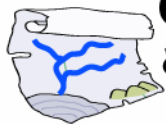


**Calculate
Impairments**



**Inspect
Output**





**Choose
a study
area**



**Build a
project**



**Extract
geospatial
data**

**Retrieve
tabular data**

**Review
Data**



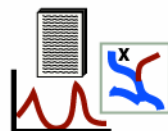
**Calculate
Impairments**



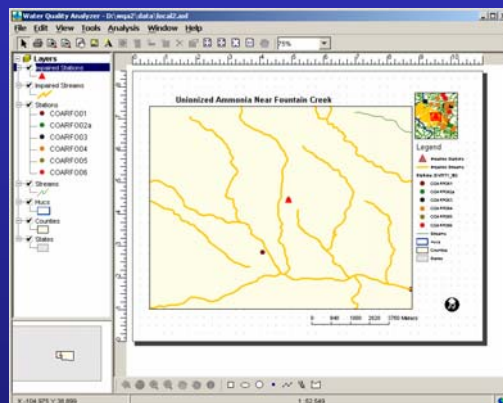
**Inspect
Output**



**Export
Results**



WQA Step 6 – Export Results



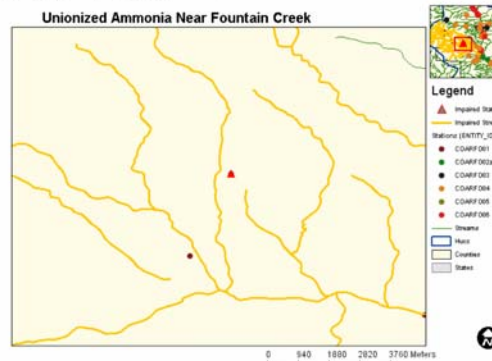
Total Results

Entity ID	Param	Fraction	Unit	No. Of Exceedances	Total Samples	Per Cent Failed	Standard	Mean Value	Min. Value	Max Value
COARF001	Ammonia, unionized		mg/l	4	82	4.90%	>0.02	0.004	0	0.0875
COARF001	Arsenic	Total	ug/l	0	56	0%	>50	1.196	0	34
COARF001	Boron	Total	ug/l	0	56	0%	>750	28.214	0	130
COARF001	Cyanide	Total	ug/l	4	6	66.70%	>0.005	0.035	0	0.18
COARF001	Dissolved oxygen (DO)		mg/l	1	89	1.10%	<=6	9.927	5.7	13
COARF001	Fecal Coliform		#/100ml	72	146	49.30%	>229	1,189.88	0	54000
COARF001	Mercury	Total	ug/l	1	1	100%	>0.01	0.5	0.5	0.5
COARF001	Nitrogen, Nitrate (NO3) as NO3	Total	mg/l	0	78	0%	>10	0.949	0	8.8

Unionized Ammonia – Fountain Creek

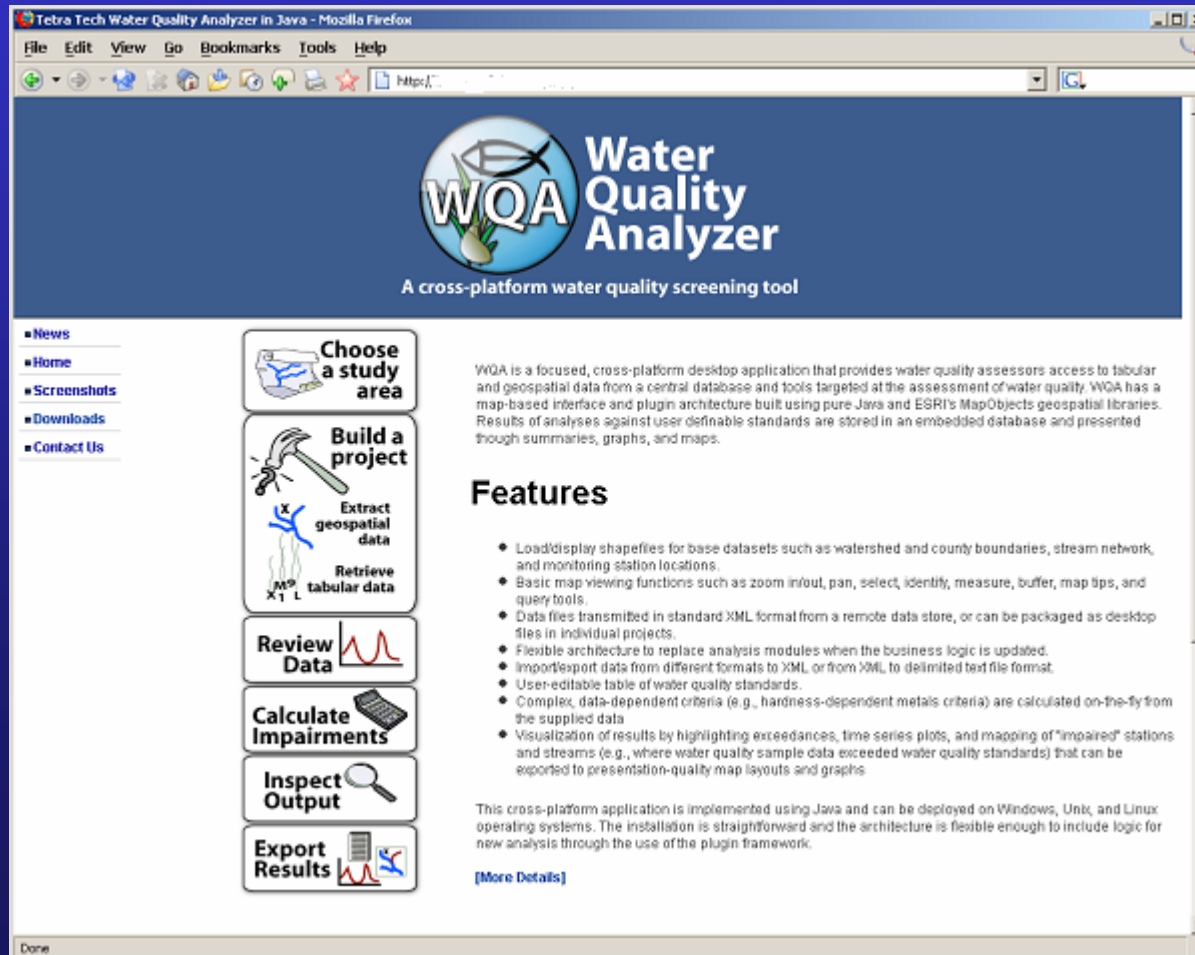
Ammonia, Unionized

Station ID	Date	Value
08041_07103700	11/7/2002	0.01
08041_07103700	12/3/2002	0.01
08041_07103700	2/14/2003	0.01
08041_07103707	11/7/2002	0.18
08041_07103707	12/5/2002	0
08041_07103707	2/13/2003	0



Future Directions

- Establish Distribution Mechanism



Future Directions

- XML Linkage with Existing Data Sources
 - STORET, USGS NWIS
- Customization of Analysis Plug-ins for End Users
 - Impairment Analysis
 - Business Rules
 - Water Quality Standards
 - Others



Thank you

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703-385-6000



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